INNER TIGHTENING MECHANISM FOR FOOTWEAR

[0001] The present invention relates to an inner tightening mechanism adapted to equip a footwear that can be used, particularly, but in a non-limiting fashion, for sporting activities.

[0002] The articles of footwear thus equipped are intended especially for snowboarding, walking in the mountains, in-line roller skating and ice skating, etc., i.e., for those sports that require the foot to be properly held.

[0003] In the prior art, there are numerous inner tightening systems that hold the foot in the flexion fold area, in the direction of the heel of the boot. However, these systems, in particular that which is described in the document EP 146 502, are associated with boots having a rigid upper, such as alpine ski boots which are constituted of a plastic shell. The inner tightening is connected to the shell in the area where the shell and of the sole are joined in order to surround the foot over a maximum portion of the foot perimeter. This type of internal tightening manages the foot volume independently of the shell and simultaneously holds the foot laterally and axially.

[0004] Thus, with a system of this type, a dimensional variation in one direction results in a clearance in the retention in the other direction. This dimensional variation can be caused especially by the compression of the inner shoe which is arranged beneath the tightening system.

[0005] The document US 4,513,520 describes a boot having a rigid upper, which is equipped with an inner tightening system arranged in the area of the foot flexion fold, and which is kept tensioned by a hooking on the top of the upper of the inner shoe of the boot. The system surrounds the inner shoe in a manner that is completely independent of the boot upper. Thus, said system presses the inner shoe against the foot. However, it does not improve the overall precision of the boot, because the tightening system only creates a free space between the inner shoe and the boot

upper.

[0006] Moreover, the present devices apply to ski boots, such as alpine ski boots where the separations of the heel are generated by forward bending movements of the ankle-knee assembly.

[0007] Therefore, one of the objects of the present invention is to propose an inner tightening mechanism adapted to equip a footwear having a flexible or semi-rigid upper, and partially surrounding the foot in the area of the flexion fold, in the direction of the heel, which provides an efficient retention of the foot.

[0008] Another object of the invention is to propose an inner tightening mechanism which surrounds the foot comfortably while respecting the specific forces applied on the footwear, especially during snowboarding.

[0009] To achieve these objects, the inner tightening mechanism includes a retention band that is connected to the inner surface of the upper of the footwear by at least two anchoring points fixed on the lateral and medial sides, respectively, of the upper. To optimize the retention of the foot by taking advantage of the flexibility of the upper, at least one anchoring point is positioned substantially above the sole, especially in the central portion of the axial length comprised between the foot and the base of the heel of the foot. The tightening is ensured by a sliding return that is associated with an anchoring point. In addition, a retention band, which is fixed at one of its ends to the other anchoring point, passes in the sliding return by covering the foot. The retention band includes an appropriate fixing means, which is located between the other end of the band and the sliding return, and which makes it possible to maintain the tension in the tightening mechanism by getting hooked to the upper of an inner shoe with which the footwear is equipped.

[0010] In a first embodiment, the footwear, which is equipped with the inner tightening mechanism, includes an inner shoe that is arranged beneath the present mechanism.

[0011] In a second embodiment, the inner tightening mechanism is in close contact with the foot.

[0012] The invention will be better understood and other advantages thereof will become apparent from the description, with reference to the annexed drawings. The description illustrates, by way of non-limiting examples, certain preferred embodiments.

[0013] Figure 1 schematically shows a perspective front view of the inner tightening mechanism according to the first embodiment.

[0014] Figure 2 schematically shows a perspective front and top view of the footwear equipped internally with the tightening mechanism according to the first embodiment.

[0015] Figure 3 schematically shows a cross-section of the footwear and of the inner tightening mechanism according to the first embodiment, along a cross-sectional plane referenced in Figure 2.

[0016] Figure 4 schematically shows a front view of a user equipped with a footwear connected to a gliding board such as a snowboard.

[0017] Figure 5 schematically shows a perspective side view of a first alternative of the inner tightening mechanism according to the first embodiment.

[0018] Figure 6 schematically shows a top view of the retention band according to the alternative embodiment shown in Figure 5.

[0019] Figure 7 schematically shows a perspective side view of the inner shoe equipping the footwear which has the inner tightening mechanism according to the first embodiment.

[0020] Figure 8 schematically shows a perspective front view of a footwear whose upper has a tear showing the inner shoe, the inner tightening mechanism according to the first embodiment.

[0021] Figure 9 schematically shows a side view of a footwear that is affixed to a gliding apparatus, and whose upper has a tear that shows the inner tightening mechanism according to a second alternative of the first embodiment.

[0022] Figure 10 schematically shows a perspective front view of a footwear whose upper has a tear showing the inner tightening mechanism according to the

second embodiment.

[0023] In Figures 1-5, the footwear CH shown is a boot having a flexible or semi-rigid upper adapted for snowboarding. A boot having a semi-rigid upper here is a boot with a flexible upper including a more or less large proportion of rigid reinforcements positioned either within or outside the upper O, and adapted to better transmit the forces and supports, but also to protect from impacts.

[0024] In Figure 1, the footwear CH is shown in broken lines in order to better visualize the inner tightening mechanism . The footwear CH includes a flexible or semi-rigid upper O which is mounted on a sole 100. The tightening mechanism, which is arranged within the upper O, incudes a retention band 1 that is connected to the inner surface Oa of the upper O by at least two anchoring points 12, 22, fixed on the lateral and medial sides, respectively, of the upper O. This retention band 1 partially surrounds the foot, between the two anchoring points 12, 22, in the area of the flexion fold of the foot, and in the direction of the heel. Once the retention band 1 is tensioned, the portion S1 of the band 1, which is located between the anchoring points 12 and 22, firmly retains the foot in the footwear CH by pressing the foot, in the area of the flexion fold, against the rear of the inner surface Oa of the upper O and the sole 100.

[0025] The tensioning of the retention band 1 is made possible due to the fact that the anchoring point 22 includes a sliding return 5 in which the retention band 1 passes. The retention band 1, which is fixed at its end 1a to the inner surface 1a of the upper O, by means of the anchoring point 12, surrounds the foot in the area of the portion S1. Then, the retention band 1 passes in the sliding return 5 and defines a portion S2 of the band 1, which is comprised between the sliding return 5 and the other end 1b of the retention band 1. Thus, the user of the footwear CH grabs the portion S2 of the retention band 1 with his hand, which is accessible because it is close to the top of the upper O, and pulls the portion S2 upward by applying a force F1. This action F1, due to the sliding of the band 1 in the return 5, makes it possible to reduce the length of the portion S1 of the retention band 1, and to tension the band

1. However, as the anchoring points 12, 22, are firmly fixed on the upper O, the shortening of the portion S1 creates a reduction in the distance between the flexion fold and the heel of the foot by making it possible to retain the foot in the area of the ankle.

[0026] The tension in the tightening mechanism, and therefore in the retention band 1 is maintained by an appropriate fixing means 7 which is advantageously arranged in the vicinity of the end 1b of the retention band 1. The fixing means 7 is adapted to ensure a removable fixing of the retention band 1 on a possible inner shoe to which another fixing means 7a is attached. The fixing means 7 can advantageously be adapted to ensure an adjustment of the position of the means 7 in relation to the fixing means 7a. Thus, advantageously but in a non-limiting manner, the fixing means 7 can be of the self-gripping type. To maintain the tension in the tightening mechanism, the user then exerts a substantially horizontal displacement D2 which brings the top of the fixing means 7 against the complementary fixing means 7a.

[0027] Of course, the user can combine the two actions of tensioning and of locking the tension in a single movement.

[0028] Figure 2 shows the footwear CH on which is referenced a surface P in which the portion S1 of the retention band 1 is positioned. As the tightening mechanism is internal to the footwear CH, the latter is not shown in Figure 2. Only the anchoring points 12, 22 are shown in broken lines. The surface P passes by the two anchoring points 12, 22, and substantially by the flexion fold of the foot. In the embodiment shown, the surface P is a transverse plane with respect to the footwear CH. This means that the anchoring points are substantially symmetrical on the upper O. Of course, to take into account the asymmetry of the ankle, especially in the area of the malleoli, the surface P can be a non-transverse plane.

[0029] Figure 3 shows a cross-section of the footwear CH shown in Figure 1 along the plane P referenced in Figure 2. The portion S2 of the retention band 1 is truncated in the drawing since it is not located in the cross-sectional plane P. The

inner tightening mechanism includes at least one anchoring point 12, 22 which is positioned substantially above the sole 100. This arrangement makes it possible to use the flexibility of the upper O for the lateral retention of the foot P. The anchoring point 12, 22 can advantageously be positioned on the central portion 2 of the flexion fold-heel line L. This line L is defined as being the line connecting the flexion fold 102 to the heel 101 of the foot P. In addition, the anchoring points 12, 22 can advantageously be obtained by seams running through the flexible or semi-rigid upper O.

[0030] In the preferred embodiment shown in Figure 3, the two anchoring points 12, 22 are arranged above the sole 100 and substantially in the central portion 2.

[0031] Respecting this constructional arrangement makes it possible to optimize the retention of the foot P in the boot CH, which is provided by the inner tightening mechanism.

[0032] On the one hand, the tension in the retention band 1 exerts a horizontal component of force F2, F3. The forces F2, F3 generate a deformation of the upper O, especially in the area of the portions Ob, Oc, which are located between the anchoring points 22, 12, and the sole 100, respectively. In view of the flexibility of the upper O, the upper portions Ob, Oc become deformed inwardly by coming closer to the foot P and by thus providing a lateral retention of the foot P.

[0033] On the other hand, the tension in the retention band 1 exerts a vertical, downward pressure F4 which, by means of the portion S1, vertically retains the foot P pressed against the sole 100.

[0034] The position of the anchoring points 12, 22 along the flexion fold-heel line L has a direct influence on the distribution between the lateral tightening and the vertical tightening of the foot. A position close to the sole 100 promotes the vertical tightening and the pressure F4. Inversely, a position close to the flexion fold 102 promotes the lateral retention by deformation of the upper portions Ob, Oc, under the effect of horizontal forces F2, F3. The best compromise was obtained for a position in the central portion 2 of the flexion fold-heel line L.

[0035] Of course, this position is only provided by way of example and is absolutely not limiting, since to each flexibility of the upper O, especially in the area of the portions Ob, Oc, corresponds a specific position with respect to Ob, Oc, for obtaining the desired tightening distribution.

[0036] To facilitate the loosening of the inner tightening mechanism, the retention band 1 advantageously includes a gripping means 8 that is arranged on the portion S1 of the retention band 1. The gripping means 8 can be a loop obtained in the form of a strap, for example, and fixed to the retention band 1 by appropriate means, such as a seam 8a.

[0037] Thus, to loosen the device, the user grabs the gripping means 8 by hand and pulls substantially upward along an action F5.

[0038] This action F5 causes the retention band 1 to slide in the return 5, and thus lengthens the portion S1 of the band 1. The user then continues to pull on the gripping means 8 to free a space between the portion S1 and the flexion fold 102 of the foot P, which is necessary for the release of the foot P from the footwear CH.

[0039] For fitting a large sized foot P, the upper O can advantageously include a housing 30 on its inner surface Oa, in the area where the sliding return 5 is located. Thus, the return 5 becomes nested in the housing 30, avoiding constituting a hard spot on the foot P. Indeed, the return 5 is most often made of a rigid material, especially plastic.

[0040] Figure 4 schematically shows a snowboarder equipped with a footwear CH which is itself connected to the snowboard SU. Figure 4 shows the specific forces applied to the footwear CH during snowboarding.

[0041] The foot which is positioned at the front of the snowboard S has a large angle α with respect to the perpendicular line, in relation to the snowboard S, which is located substantially in the axis of the snowboard S and on the medial side of the foot. Thus, the footwear CH must allow this movement while ensuring the retention and the comfort of the foot during such movement.

[0042] Figure 5 shows a variation of the tightening mechanism which, particularly

but in a non-limiting fashion, makes it possible to meet the specific requirements of snowboarding.

[0043] The footwear CH, which includes the inner tightening mechanism, is shown in broken lines. This variation is different from the embodiment shown in Figures 1 and 3 essentially with respect to the portion S1 of the retention band 1, which surrounds the foot in the area of the flexion fold. The portion S2 of the band 1 as well as the means for fixing the portion S2 remain similar to the previous embodiments.

[0044] In this variation, the retention band 1 includes a fork 15 which comprises two arms 16, 17. The arm 16 integrates the anchoring point 12 which is consistent with the description of the embodiment shown in Figures 1 and 3. The arm 17 is fixed to the inner surface Oa of the upper O by a complementary anchoring point 32 that is positioned on the same side of the upper O as the anchoring point 12. The complementary anchoring point 32 can be obtained especially by sewing the arm 17 on the inner surface O. The arm 16 is positioned substantially along the primary direction 1002 which passes by the base of the heel and by the flexion fold of the foot. In addition, the arm 17 also passes by the flexion fold, but along a secondary direction 1001 that is less inclined than the primary direction 1002. The axial length 3 and the secondary direction 1001 are shown in Figure 5 in broken lines.

[0045] However, the secondary direction 1001 remains inclined rearwardly, and the arms 16, 17 are fixed to the upper O on the medial side of the footwear CH.

[0046] Respecting this constructional arrangement makes it possible to retain the foot, in the area of the flexion fold, without exerting any localized excess pressure point on the medial side of the foot, especially in the area of the first cuneiform and carpal bones of the foot, which constitutes a protuberance on the inner surface of the foot. Indeed, the arm 16 passes above the bones whereas the arm 17 passes in front of them. The arms 16, 17 are joined by forming a fork 15 and are extended in the direction of the sliding return 5 by a single arm 104. The fork 15 is located substantially in the area of the flexion fold of the foot.

[0047] Therefore, the portion S1 of the retention band 1 can advantageously be obtained in a single piece including the single arm 104 and the arms 16, 17, also made of the same material. However, it can be interesting to use different materials for the arm 16 and the arm 17, especially with respect to the elasticity of the materials. To better adapt the geometry of the fork 15 to the foot of each user, and therefore to better distribute the pressures on the foot, one arm, especially the arm 17, can advantageously be made of a material that is more elastic than the constituent material of the other arm, especially the arm 16.

[0048] By way of a non-limiting example, interesting results in terms of comfort and holding of the foot have been obtained for a geometry such that the anchoring point 12 is arranged substantially at 7.5 cm from the heel and at 3.7 cm from the top of the sole, and the anchoring point 32 is arranged at 15.7 cm from the heel and at 2.5 cm from the top of the sole.

[0049] Of course, other locations of the anchoring points 12, 32, remain consistent with the invention given that the location also depends on the geometry of the footwear CH, especially with respect to the flexion fold.

[0050] Figure 6 shows an alternative embodiment of the fork 15 shown in the previous Figure. The retention band 1 includes, in its position S1 which covers the foot P, the fork 15 that is divided into two arms 16, 17 as described previously. However, the fork 15 is positioned beyond the longitudinal axis X of the footwear and on the side of the sliding return. Thus, the retention band 1 includes a recess 31 arranged at the junction of the two arms 16, 17 and of the fork 15. This recess 31 is advantageously centered around the longitudinal axis X. This position, which places the recess 31 in the area of the flexion fold of the foot, makes it possible to increase the comfort of the foot during forward axial bendings. Indeed, during these biases, the recess 31 enables a deformation by bending of the fork 15 which comes closer to the arms 16, 17. In most sporting activities using a footwear having a flexible or semi-rigid upper which can be equipped with the present inner tightening mechanism, the footwear is subject to bendings in the longitudinal plane passing by

X, especially toward the front. However, during bendings of this type, the portion S1 of the retention band 1 applies pressures in the area of the flexion fold of the foot, which can possibly prove painful for certain sensitive feet. This is why the following Figures show improvements or alternative embodiments making it possible to improve the comfort in the area of the flexion fold of the foot.

[0051] In Figure 7, the inner shoe CH', with which the previously shown footwear is equipped, forms an envelope around the foot, between the foot and the inner tightening mechanism which is on the outer upper. The inner shoe CH' includes at least two raising elements 10, 11, which are fixed on the lateral side and on the medial side, respectively, of the inner shoe CH'. In addition, the raising elements 10, 11, are arranged such that the portion S1 of the retention band, previously designated by the reference numeral 1, takes support especially on the raising elements 10, 11, without exerting excessive pressures on the top 103 of the inner shoe CH', in the area of the flexion fold.

[0052] The raising elements 10, 11 are fixed outside the upper O' of the inner shoe CH', substantially along the axial length comprised between the flexion fold and the heel of the foot. These elements 10, 11, have an excess thickness with respect to the remainder of the of the upper O' of the inner shoe CH'. Thus, the retention band, by taking support on the raising elements 10, 11, moves away from the inner shoe CH', especially on the top 103, and thus exerts less pressure in the area of the flexion fold 102.

[0053] The raising elements 10, 11, which could advantageously be made of foam, have an excess thickness comprised between 5 and 20 millimeters, and can be arranged sufficiently close to the top 103 of the inner shoe CH'.

[0054] In Figure 8, the footwear CH shown is a boot for walking in the mountains, and especially in cold weather, for it is equipped with a removable inner shoe CH' which includes an upper O'. Additionally, the upper O' of the inner shoe CH' includes a fixing means 27 that is complementary to the fixing means 7, itself positioned on the portion S2 of the retention band 1. The fixing means 27 can

advantageously be positioned on the top portion of the upper O' and on its lateral side. Thus, to tighten inner tightening mechanism, the user exerts a force oriented upward and outward of the foot. Similarly, the anchoring point, which includes the previously described sliding return, is positioned on the medial side of the footwear CH. The fixing means 27, 7 are advantageously of the self-gripping type. In addition, the anchoring points 12 are advantageously obtained by seams on the upper O of the boot CH. The boot CH currently shown includes a sole 100 overlaid by a 100b made of a rigid material for it is adapted to cooperate with the cleats. Thus, at least one anchoring point 12 is positioned on the upper O that is flexible or semi-rigid, and therefore above the backer 100b.

[0055] Figure 8 also shows a retention band 1 that takes support, in the area of its portion S1, on the inner shoe CH', in the area of the raising element 10.

[0056] In Figure 9, the footwear CH shown is an in-line roller skate including a rolling device 200. The footwear CH includes an inner shoe CH' which is seen through a tear in the upper O of the footwear CH. The upper O here is constituted of a flexible envelope 201, arranged especially at the level of the instep, which is coupled here to rigid reinforcing elements 202, 203. These reinforcing elements 202, 203 are respectively connected to the rolling device 200 and make it possible to stabilize the ankle laterally. Therefore, the upper O is indeed an upper of the semi-rigid type as previously defined.

[0057] In this embodiment, the inner tightening mechanism includes at least one distribution plate 13 that is fixed beneath the retention band 1, in the area of the portion S1. The distribution plate 13 is positioned substantially at the level of the flexion fold 102 and between the inner shoe CH' and the upper O of the footwear CH. This distribution plate 13, which can advantageously be made of a thermoplastic material, makes it possible to distribute, on the top of the inner shoe CH', the pressure exerted by the portion S1 of the retention band 1. The means here for locking the tension in the inner tightening mechanism is of the same type as that previously mentioned.

[0058] However, the point 12 for anchoring the retention band 1 on the upper O, fixed in the rigid reinforcement 202, can advantageously be obtained by means of a rivet.

[0059] In Figure 10, the footwear CH shown is a walking boot having a flexible or semi-rigid upper O. The footwear CH includes, within its upper O, an inner envelope 205 that is positioned laterally between the flexion fold and the heel. The envelope 205 is also positioned beneath the portion S1 of the retention band 1 of the inner tightening mechanism. To improve the comfort, the envelope 205 includes at least one raising element 206 that is positioned along the axial length as defined previously. This raising element 206 has an excess thickness with respect to the envelope 205 and in the direction of the upper O. In addition, the portion S1 of the retention band 1 is positioned on the raising element 206 so as to distribute the tightening pressure of the inner tightening mechanism, and to avoid the excess pressures on the foot in the area of the flexion fold.

[0060] The tension is maintained in the retention band 1 by a fixing means 29 that is arranged on the inner surface Oa of the upper O of the footwear CH and which is complementary to the fixing means 7 arranged on the portion S2 of the retention band 1. In the preferred embodiment shown in Figure 10, the footwear CH has a tongue 207, and the fixing means 29 is arranged on the tongue 207, thus being inserted between the tongue 207 and the upper O. The tongue 207, which is positioned beneath the envelope 205, also makes it possible to dissipate the excess pressures generated by the inner tightening mechanism on the foot.

[0061] Another alternative embodiment, not shown, includes positioning, on the portion S1 of the retention band 1, a fixing means that is complementary to the fixing means 7 that is arranged on the portion S2 of the retention band 1. This cooperation between the fixing means makes it possible to maintain the tightening tension in the retention band 1.

[0062] Of course, the present invention is not limited to the embodiments described hereinabove, which are provided for guidance only, but encompasses all similar or

equivalent embodiments. The present invention also includes the footwear equipped with the inner tightening mechanism.